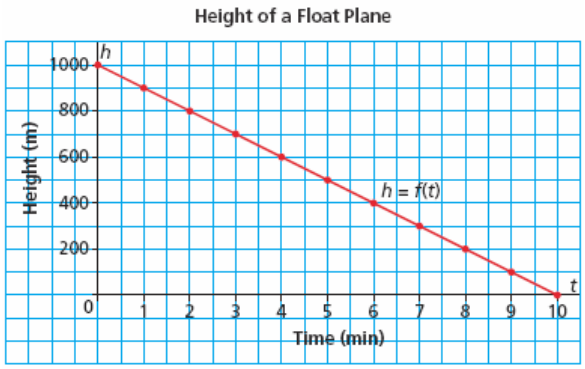
5.7 Interpreting Graphs of Linear Functions

LESSON FOCUS Use intercepts, rate of change, domain, and range to describe the graph of a linear function.

Make Connections

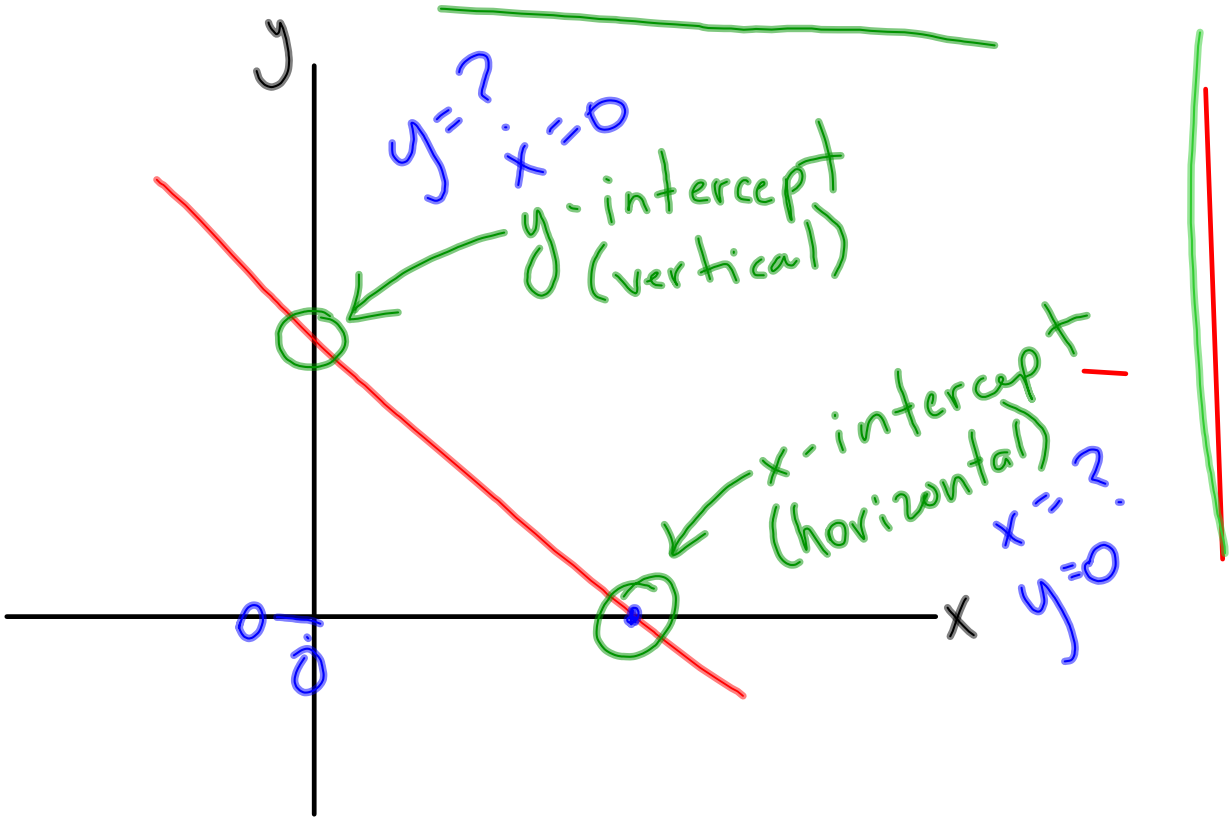
Float planes fly into remote lakes in Canada's Northern wilderness areas for ecotourism. This graph shows the height of a float plane above a lake as the plane descends to land.



Where does the graph intersect the vertical axis?
What does this point represent?

Where does the graph intersect the horizontal axis? What does this point represent?

What is the rate of change for this graph? What does it represent?



TRY THIS

Work in a group.

You will need grid paper.

Dogsled tours are run between Armstrong cabin and Irving cabin. The cabins are 100 km apart.

Dogsled team 1 travels at an average speed of 20 km/h and starts its tour at Armstrong cabin.

Dogsled team 2 travels at an average speed of 25 km/h and starts its tour at Irving cabin.

One pair of students chooses team 1 and the other pair chooses team 2.

TRY THIS (continued)

A. Copy and complete the table to show the distance from Irving cabin at different times on the tour.

Team 1

Time (h)	Distance from Irving Cabin (km)
0	100
1	

Team 2

Time (h)	Distance from Irving Cabin (km)
0	0
1	

B. Draw a graph to show the distance from Irving cabin as a function of time.

TRY THIS (continued)

C. Share your results with the other pair of students.

- How are the graphs the same? How are they different?
- Identify where each graph intersects the vertical and horizontal axes. What do these points represent?
- Determine the rate of change for each graph. What does it represent?
- What are the domain and range for each graph?

Complete the table to show the distance from Irving cabin at different times on the tour.

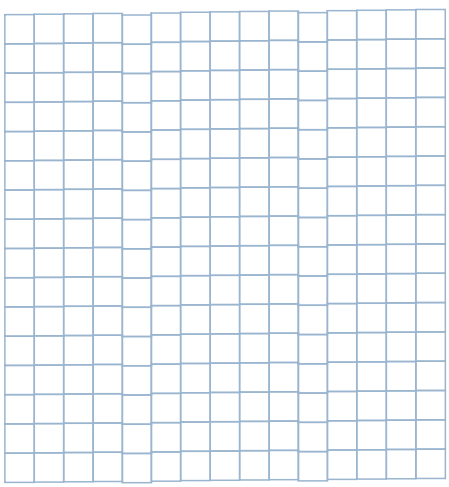
Team 1

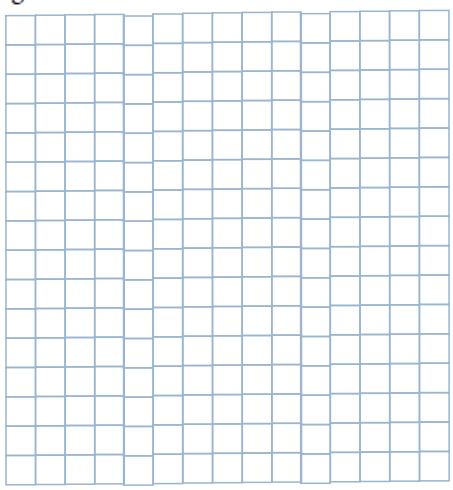
Time (h)	Distance from Irving Cabin (km)
0	100
1	

Team 2

Time (h)	Distance from Irving Cabin (km)
0	0
1	

Draw a graph to show the distance from Irving cabin as a function of time.





How are the graphs the same? How are they different?

Identify where each graph intersects the vertical and horizontal axes. What do these points represent?

Determine the rate of change for each graph. What does it represent?

What are the domain and range for each graph?

Section 5.7

Any graph of a line that is not vertical represents a function. We call these functions **linear functions.**

Why are vertical lines not considered to be "functions"?

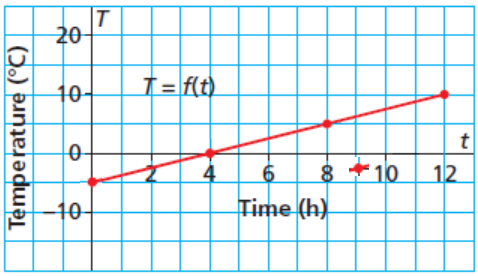
Intercepts:

1. Where the line crosses the horizontal axis is called the horizontal intercept (also known as the x-intercept). What will be the value of y for any horizontal intercept? y=0

2. Where the line crosses the vertical axis is called the vertical intercept (y-intercept). The value of x will be? x=0

This graph shows the temperature, T degrees Celsius, as a function of time, t hours, for two locations.

Temperature in Location A

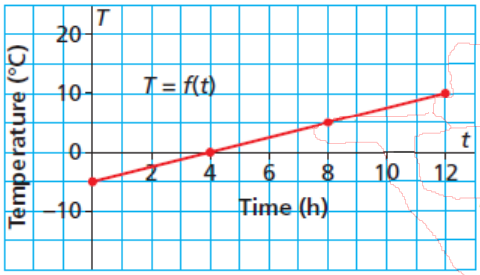


The point where the graph intersects the horizontal axis has coordinates ?
The **horizontal intercept** is ? This point of intersection represents the time, after ? when the temperature is ?

The point where the graph intersects the vertical axis has coordinates ?
The **vertical intercept** is ? This point of intersection represents the initial temperature, ?

5.7 Interpreting Graphs of Linear Functions

Temperature in Location A



The *domain* is: ?

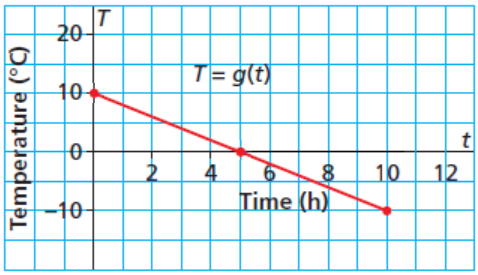
The *range* is: ?

The *rate of change* is: $\dfrac{\text{change in } T}{\text{change in } t} = \dfrac{?}{?}$

$= ?$

The rate of change is positive because the temperature is increasing over time.

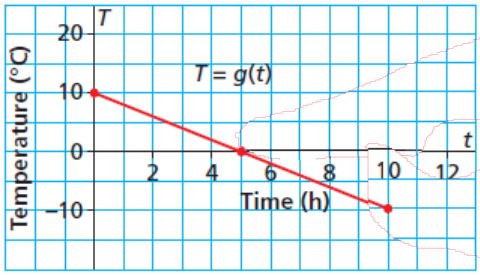
Temperature in Location B



The point where the graph intersects the horizontal axis has coordinates ?
The *horizontal intercept* is ? This point of intersection represents the time, after ? when the temperature is ?

The point where the graph intersects the vertical axis has coordinates ?
The *vertical intercept* is ? This point of intersection represents the initial temperature, ?

Temperature in Location B



The *domain* is: ?

The *range* is: ?

The *rate of change* is: $\frac{\text{change in } T}{\text{change in } t} = \frac{?}{?} = ?$

The rate of change is negative because the temperature is decreasing over time.

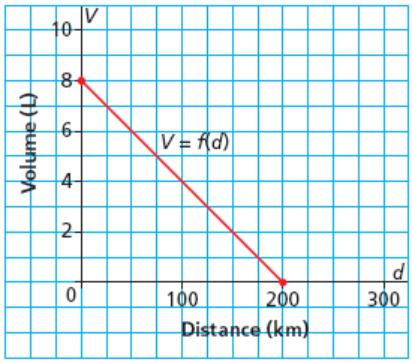
Example 1 Determining Intercepts, Domain, and Range of the Graph of a Linear Function

This graph shows the fuel consumption of a scooter with a full tank of gas at the beginning of a journey.

a) Write the coordinates of the points where the graph intersects the axes. Determine the vertical and horizontal intercepts. Describe what the points of intersection represent.

b) What are the domain and range of this function?

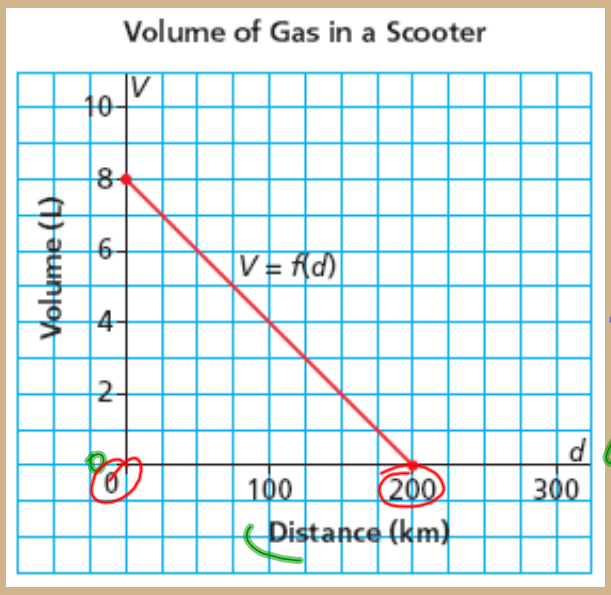
Volume of Gas in a Scooter



SOLUTION

CHECK YOUR UNDERSTANDING

Practice Question



#1 What are the intercepts and what do they mean?

x-intercept is 200
→ At 200 km, the volume of gas is 0 L.

y-intercept is 8
→ At 8 L, the distance travelled is 0 km.

#2 What is the domain and range?

Domain is $0 \leq x \leq 200$ (x-values)

Range is $0 \leq y \leq 8$ (y)

Practice Question: Please fully answer the following:

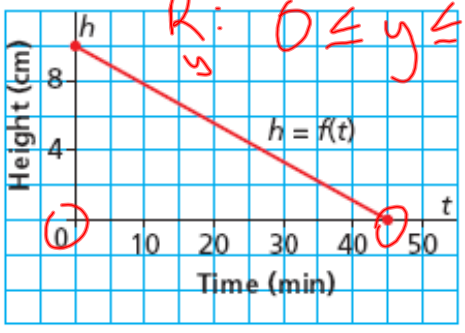
1. This graph shows how the height of a burning candle changes with time.

a) Write the coordinates of the points where the graph intersects the axes. Determine the vertical and horizontal intercepts. Describe what the points of intersection represent.

b) What are the domain and range of this function?

D: $0 \leq x \leq 45$

R: $0 \leq y \leq 10$

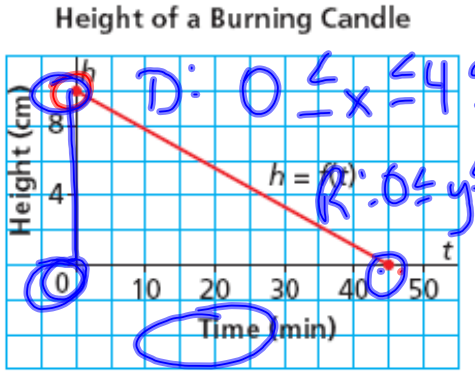


Practice Question: Please fully answer the following:

1. This graph shows how the height of a burning candle changes with time.

a) Write the coordinates of the points where the graph intersects the axes. Determine the vertical and horizontal intercepts. Describe what the points of intersection represent.

b) What are the domain and range of this function?



D: $0 \leq x \leq 45$

R: $0 \leq y \leq 10$

y-int. is 10. At 10cm, the time is 0

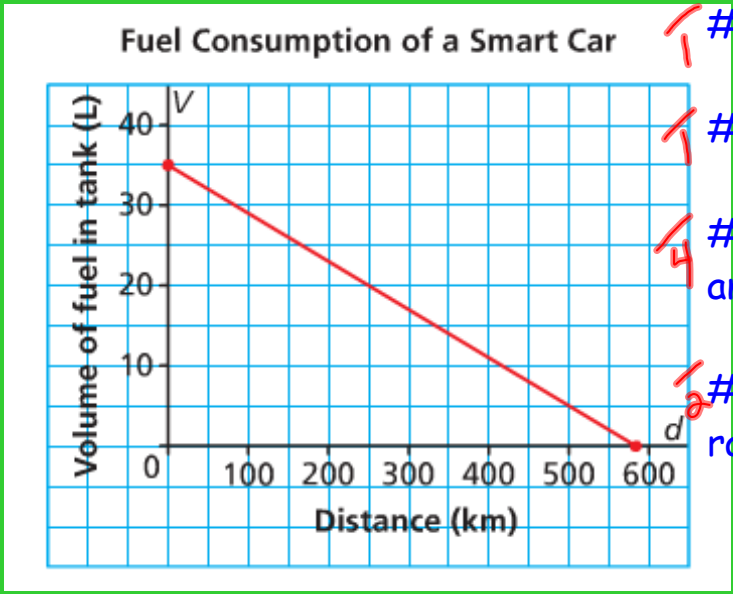
x-int is 45. At 45mins, the height is 0

Friday, December 2nd

- Review yesterday's practice question
- Warm-up #9
- Learn how to determine the intercepts of a line using the equation, not the graph
- Practice Questions

Please Note: There will be a Chapter 5 test on Wednesday

Warm-up #9



1 #1 Is this graph a function?

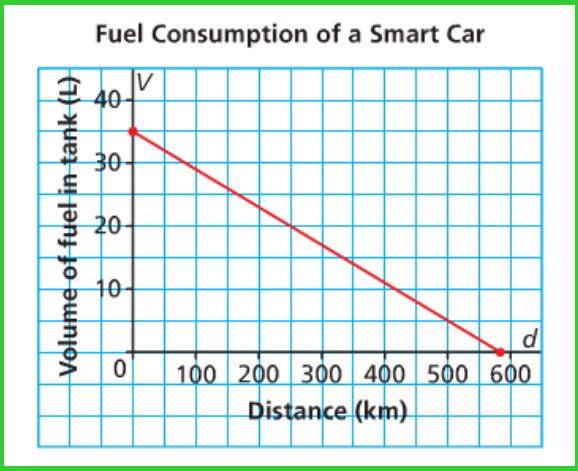
1 #2 Is this graph linear?

4 #3 What are the intercepts and what do they mean?

2 #4 What is the domain and range?

/8

Warm-up #9



#1 Is this graph a function?

#2 Is this graph linear?

#3 What are the intercepts and what do they mean?

#4 What is the domain and range?

How to determine the intercepts when you are not given the graph, but are given the equation:

Lets use the equation y = 3x + 5

To find the x-intercept (the horizontal intercept): $y=0$ $x=?$

$y = 3x + 5$ Fill in "0" for y

$0 = 3x + 5$ Solve for x

$-5 \quad -5$

$\frac{-5}{3} = \frac{3x}{3}$ $x = \frac{-5}{3}$ or -1.67

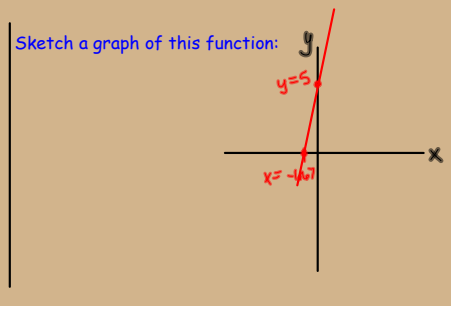
To find the y-intercept (the vertical intercept): $x=0$ $y=?$

$y = 3x + 5$ Fill in "0" for x

$y = 3(0) + 5$ Solve for y

$y = 5$

Sketch a graph of this function:



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$-5 \quad -5$

$\frac{-5}{3} = \frac{3x}{3}$ $x = \frac{-5}{3}$ or -1.67

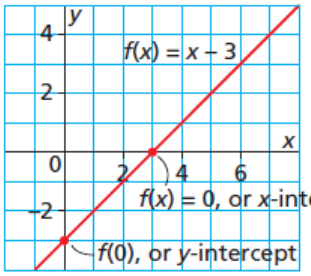
To find the y-intercept (the vertical intercept): $x=0$ $y=?$

$y = 3x + 5$

$y = 3(0) + 5$

$y = 5$ y-int. is 5.

We can use the intercepts to graph a linear function written in function notation.
To determine the y-intercept, evaluate $f(x)$ when $x = 0$; that is, evaluate $f(0)$.
To determine the x-intercept, determine the value of x when $f(x) = 0$.

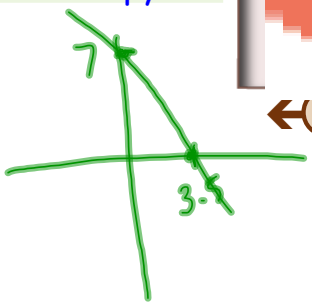


Example 2 Sketching a Graph of a Linear Function in Function Notation

copy

Sketch a graph of the linear function $f(x) = -2x + 7$.

Ex: $y = -2x + 7$



x-int
(y=0)

$0 = -2x + 7$
$-7 \quad -7$
$\frac{-7}{-2} = \frac{-2x}{-2}$
$x = \frac{-7}{-2} = 3.5$

y-int
(x=0)

$y = -2(0) + 7$
$y = 7$

CHECK YOUR UNDERSTANDING

SOLUTION

Monday, December 5th

- Review how to determine the intercepts of a line using the equation, not the graph
- Look at a couple of examples using the intercepts
- Practice Questions

Please Note: There will be a Chapter 5 test on Wednesday

Practice Question:

CHECK YOUR UNDERSTANDING

2. Sketch a graph of the linear function $f(x) = 4x - 3$.

x-int. y-int.

$y = 4x - 3$

Graph
↳ table of values
↳ plot points

x-int. ($y = 0$)

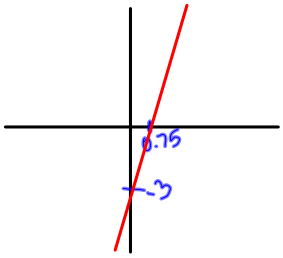
$0 = 4x - 3$
$+3 \quad +3$
$\frac{3}{4} = \frac{4x}{4}$
$x = 0.75$

x-int $(0.75, 0)$

y-int ($x = 0$)

$y = 4(0) - 3$
$y = -3$

$(0, -3)$



$y = 10x + 2$

x-int: ? $(y = 0)$

$0 = 10x + 2$

$-2 \quad -2$

$\frac{-2}{10} = \frac{10x}{10}$

$-0.2 = x$

$x = -0.2$

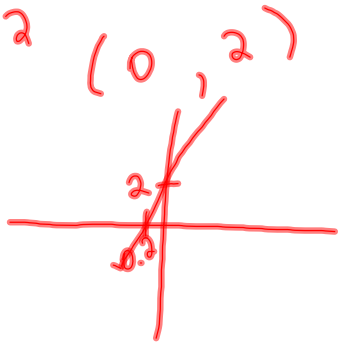
$(-0.2, 0)$

y-int $(x = 0)$

$y = 10(0) + 2$

$y = 2$

$(0, 2)$

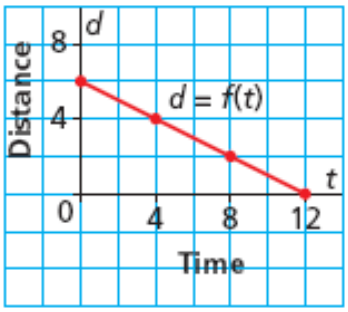


Example 3 Matching a Graph to a Given Rate of Change and Vertical Intercept

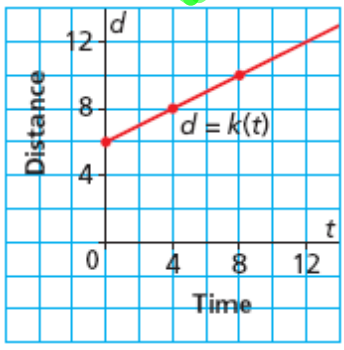
Which graph has a rate of change of $\frac{1}{2}$ and a vertical intercept of 6? Justify the answer.

The rate of change in "a" is negative

a)



b)



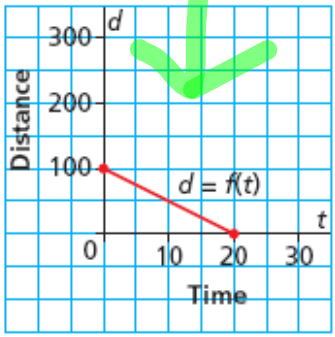
CHECK YOUR UNDERSTANDING

5.7 Interpreting Graphs of Linear Functions

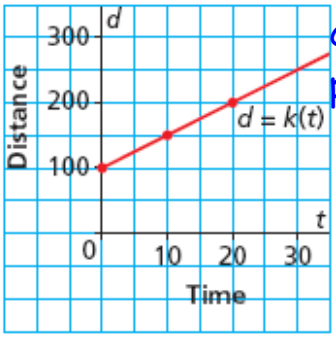
SOLUTION

3. Which graph has a rate of change of −5 and a vertical intercept of 100? Justify your answer.

a)



b)



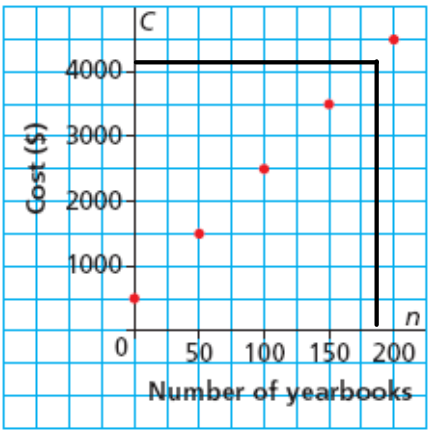
The rate of change in "b" is positive.

Example 4 Solving a Problem Involving a Linear Function

This graph shows the cost of publishing a school yearbook for Collège Louis-Riel in Winnipeg.

The budget for publishing costs is $4200. What is the maximum number of books that can be printed?

Cost of Publishing a Yearbook



Method 1: just read it off of your graph (gives an estimated value)

Method 2: find and use an equation (gives the exact answer)

CHECK YOUR UNDERSTANDING

5.7 Interpreting Graphs of Linear Functions

SOLUTION

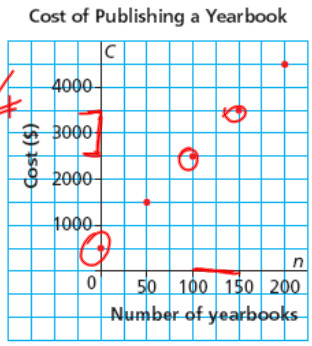
Example #4

Making an equation, given a graph

We need:

1. The fixed cost (or y-int) = 500
2. The rate of change

$\frac{\Delta y}{\Delta x} = \frac{1000}{50} = \$20$/#



Equation:

$C = 20x + 500$

How many yearbooks can be ordered for \$4200?

$4200 = 20x + 500$

$-500 \quad -500$

$3700 = 20x$

$\frac{3700}{20} = \frac{20x}{20}$

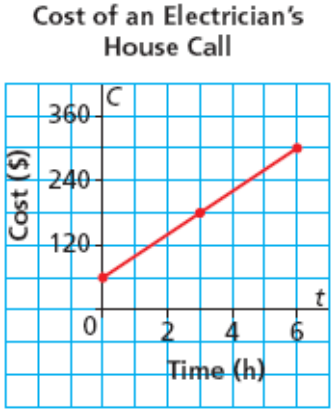
$x = 185$ yearbooks

150
35

184.2

Practice Question:

4. This graph shows the total cost for a house call by an electrician for up to 6 h work.



The electrician charges \$190 to complete a job. For how many hours did she work?

Classwork/Homework

Pg.319 #4 to 6

Tuesday, December 6th

- Check and go over yesterday's homework (#4-6)
- Do a couple more questions from Section 5.7
- Review for tomorrow's test!!!

Please Note: There will be a Chapter 5 test on Wednesday

Classwork/Homework

Pg.319 #4 to 6

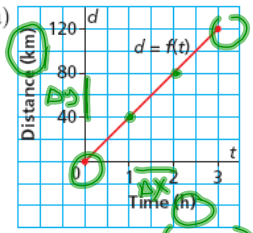
4. Each graph below shows distance, d kilometres, as a function of time, t hours. For each graph:

i) Determine the vertical and horizontal intercepts. Write the coordinates of the points where the graph intersects the axes.

ii) Determine the rate of change.

iii) Determine the domain and range.

a)

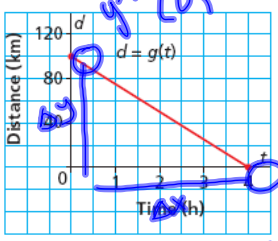


i) zero (0,0)

ii) $\frac{\Delta y}{\Delta x} = \frac{40}{1} = 40$ Km/h

iii) D: $0 \leq x \leq 3$
R: $0 \leq y \leq 120$

b)



y-int (0, 100)

x-int (4, 0)

ii) $\frac{100}{4} = 25$ Km/h

iii) D: $0 \leq x \leq 4$

R: $0 \leq y \leq 100$

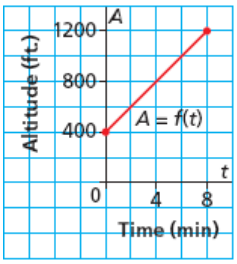
5. Each graph shows the altitude, A feet, of a small plane as a function of time, t minutes. For each graph:

i) Determine the vertical intercept.
Write the coordinates of the point where the graph intersects the axis.

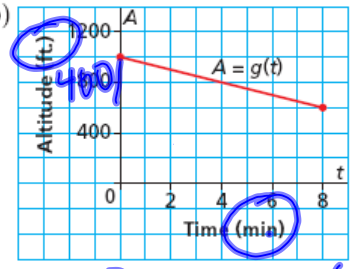
ii) Determine the rate of change.

iii) Determine the domain and range.

a)



b)



$\frac{400}{8} = -50$ ft./min

6. Sketch a graph of each linear function.

a) $f(x) = 4x + 3$ b) $g(x) = -3x + 5$

c) $h(x) = 9x - 2$ d) $k(x) = -5x - 2$

intercepts

x-int ($y = 0$)

$y = -3x + 5$

$0 = -3x + 5$

$-5 \quad -5$

$\frac{-5}{-3} = \frac{-3x}{-3}$

$x = \frac{5}{3}$ or 1.6

(x, y)

(1.6, 0)

y-int ($x = 0$)

$y = -3(0) + 5$

$y = 5$

x y

(0, 5)

Classwork/Homework

Pg.319 #7,8,9

Review for your test!!!